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Southwestern Gondwana's Permian climate amelioration recorded in coal-bearing deposits of the Moatize sub-basin (Mozambique)

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Abstract

The postglacial climate history of Gondwana represents the most prominent climate amelioration in the Phanerozoic, ranging from severe icehouse conditions in the Late Carboniferous (Pennsylvanian) to extreme hothouse conditions in the Early Triassic. Here we report new sedimentological and palynological data from a 350 m thick coal-bearing succession intersected by borehole 945L_0022, drilled in the eastern Tete Province of Mozambique, which documents southwestern Gondwana's Permian postglacial climate amelioration. Palynofacies data further support the environmental reconstructions interpreted from the sedimentary succession. Changes in the palynomorph assemblage document a shift from cold, to cool-temperate, to warm-temperate climatic conditions. This climate signature corresponds with observations from other depositional environments elsewhere in southern Africa, and thus enables correlation on a regional to interregional scale. Thick lacustrine deposits are described within the lower coal-bearing succession, reflecting the final glacial retreat, with melt waters supplying fresh water to the incipient lacustrine system. Lakes as characteristic postglacial sedimentary sinks are excellent palaeoclimate archives and the high Total Organic Carbon content of these fine-grained clastic sediments also makes them potential source rock targets for oil and gas.

Keywords: Palaeoclimate; Sedimentology; Palynology; Permian; Moatize sub-basin; Mozambique

1. Introduction

The Karoo-aged basins of southern Africa exhibit a nearly continuous sedimentary record from the Late Carboniferous (Pennsylvanian) to the Early Jurassic, and record a prominent period of Phanerozoic climate amelioration following the Gondwanan Carboniferous glaciation (Falcon, 1986, 1989; Cairncross, 1989, 2001; Wopfner, 2002; Catuneanu et al., 2005; Scheffler et al., 2006; Isbell et al., 2008; Scotese, 2016). Permian postglacial coals in particular are unique climate archives, and the palynological record of coal deposits of the Main Karoo Basin in South Africa has been recently studied with respect to climate signatures (Götz and Ruckwied, 2014; Ruckwied et al., 2014; Wheeler and Götz, 2016, 2017).

Recent exploration of coal in the eastern part of the Tete Province of Mozambique has made much new core material available. Palynological studies have so far focused on the stratigraphic placement of formations of the lower Karoo sequence (Lopes et al., 2014; Pereira et al., 2014), the Permian–Triassic transition (Pereira et al., 2016), and the climate history of the late Guadalupian–early Lopingian interval (Götz et al., 2017). Here, we report sedimentological and palynological data from Permian coal deposits intersected by a continuously cored borehole from the Moatize sub-basin. A preliminary palynostratigraphic

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